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CONSUMERS' PERCEPTION OF MUNICIPAL WATER QUALITY IN BARNAWA COMMUNITY OF KADUNA STATE, NIGERIA

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ABSTRACT
The study assessed consumers' perception regarding the quality of municipal tap water distributed by the Kaduna State Water Board (KSWB) to the residents of Barnawa community of Kaduna state. Simple judgemental sampling was employed to select four hundred and twenty seven (427) households that were interviewed through questionnaire. Data obtained were analysed using descriptive statistics, chi square, t-test and ANOVA. Majority of the respondents (60%) reportedly receive intermittent municipal water supply while a sizeable proportion of the respondents (40%) reportedly received a constant municipal water supply. Again, a little above half of the respondents (52.1%) had a negative perception of the water quality. Majority (64%) of the respondents were not satisfied with the colour of the water. The association between consumer's perception and use of tap water for drinking is statistically significant (χ^2 = 4.345, p=0.04). Customers' perception of the water quality affected their choice of the water for drinking but this did not affect their usage of the water for cooking. It is therefore recommended that KSWB should implement a system that ensures constant water supply to Barnawa community as intermittent water supply increases the risk of the water getting contaminated in the distribution system before reaching the final consumers.

Keywords: Kaduna state water board, Water supply, Respondents, Contaminated water.

INTRODUCTION

It has been widely established in the literature that water is indispensable for life and socio-economic development of any society. It is employed for domestic activities, agricultural activities, generation of power, running industries and recreational activities. Water constitutes 60%-70% of the total body weight (United States Geological Survey, 2009; Guyton and Hall, 2011). According to Adeleye *et al*. (2018), the wellbeing of humans in their immediate environment is principally measured by the availability and proximity of potable water meant for their consumption. In spite of its importance in sustaining livelihood, it is the major cause of morbidity and mortality because of limitations in access and quality (Andrew, 1998).

The quality of potable water and the threat of waterborne diseases such as cholera and typhoid are critical public health issues in many developing countries (Asian Development Bank, 2002). About 2.3 billion people in the world, most of them in developing countries, suffer from disease linked to water (Lundqvist and Gleick, 1997; Population Information Programme, 2002). Each year, four to five million people die from diseases caused by unsafe drinking water (United Nations Development Programme, 2002; Water Dome, 2002). According to Gleick (2002), if the situation is not improved upon, between 34 to 76 million people might die from water-related diseases by the year 2020. Population growth and rising living standards increase the pressure on the current water sources and systems. Most distribution systems are not designed to serve growing population; eventually they break down and become non-operational. In developing countries like Nigeria, many existing water distribution systems are operating intermittently and at a fraction of their capacity and the resulting water quality may be poor (World Health Organization and United Nations Children's Fund,2000).

Consumer perceptions and aesthetic criteria need to be considered when assessing drinking water supplies even though they may not adversely affect human health (World Health Organization and United Nations Children's Fund, 2000), but in order to improve any kind of service, it is important to understand the opinions and perceptions of the consumers before intervention. It is therefore on these premises that this study was conducted to assess the consumers' perception regarding the quality of drinking water distributed by Kaduna State Water Board (KSWB) to households in Barnawa

community with a view to understanding how their perception would ultimately affect its usage for drinking and cooking.

MATERIALS AND METHOD

Study Area

Barnawa community is located in Kaduna South Local Government Area of Kaduna State as shown in Figure 1. It is located at longitude 10° 29'' 22'' and latitude 07° 25' 26'' as observed from Astro Hill (College of Environmental Studies), and lies at a distance of about 6 kilometres from Kaduna city centre. It shares boundaries to the East with Narayi; to the West it is bordered by Kakuri and Unguwar Television to the south while at the North it is bordered by River Kaduna.

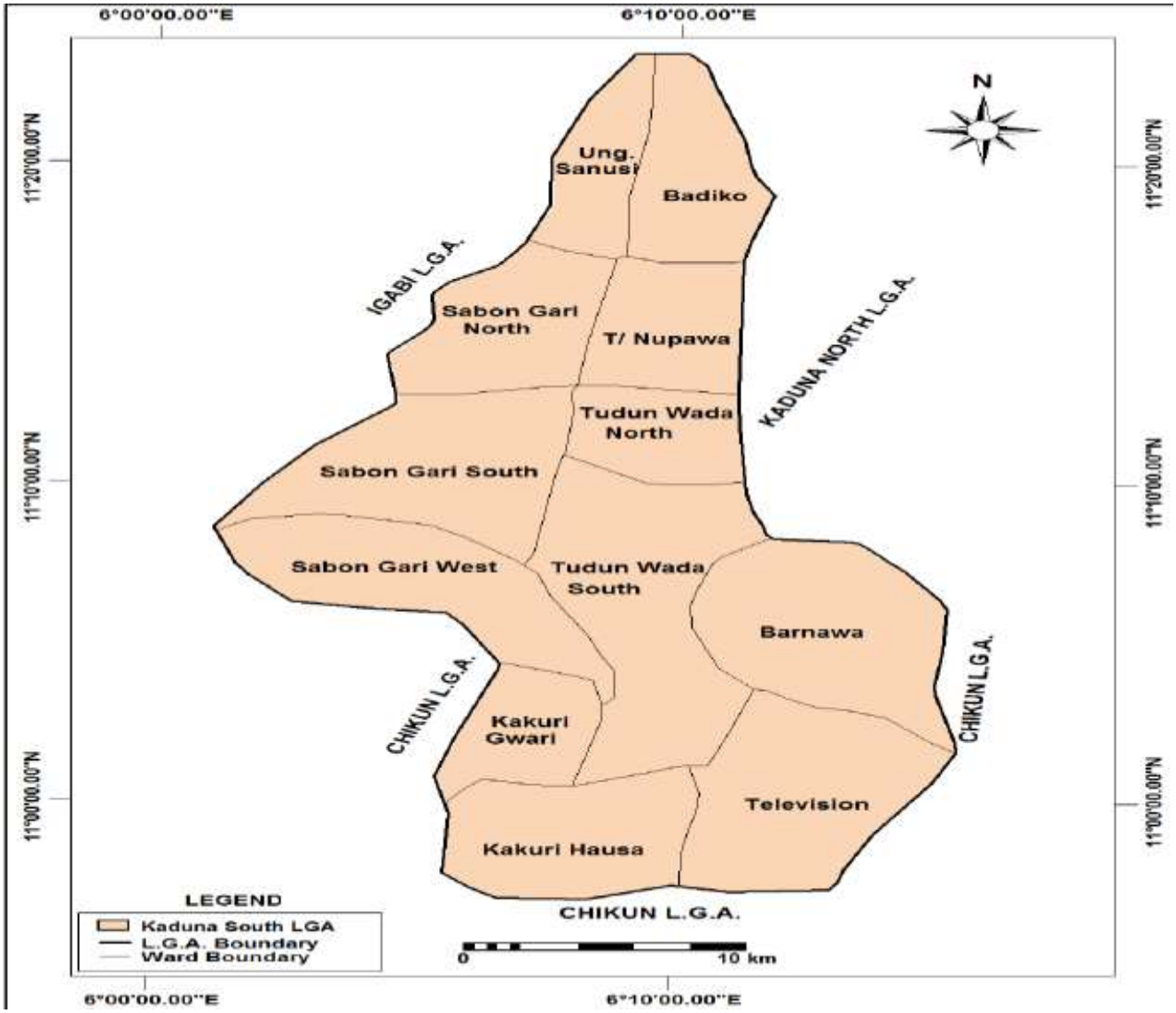

Fig. 1: Kaduna South LGA showing the wards including the study area, Barnawa.
Source: Adapted from political map of Kaduna South LGA

According to National Population Commission (1991), its coverage extends to a land area of about 10,350 hectares with an estimated population of 32,684.

Sampling technique

Households were selected using judgemental sampling method. Data from KSWB documenting the names and home addresses of all domestic pipe-borne water consumers in the study area was obtained to select a total of 427 households using a table of random numbers.

Instrument for data collection

Well-structured questionnaire was developed for data collection. The questionnaire consisted of four sections as follows: socio-demographic characteristics of respondents, identification of water supply and use by respondents, perception assessment of respondents on the water quality supplied to their households (perception scores of ≤4 and >4 were categorised as negative and positive respectively (Aluko *et al*., 2016) and identification of water borne diseases in respondents region and their practices in relation to household water storage and treatment. The questionnaire included both close and open ended questions.

Validity and reliability of the Instrument

The reliability of the questionnaire was ascertained using Cronbach's Alpha statistics. This was done by administering the questionnaire to 10% of the sample size of the respondents in a different location (Kakuri) to check whether the wordings and responding categories of the questionnaire were appropriate for the survey population, and to expunge any ambiguous questions the site chosen for pre-test. Subsequently, the reliability coefficient was calculated using SPSS software. A reliability coefficient of 0.72 was obtained, higher than the average correlation coefficient of 0.5 indicating that the instrument was reliable.

Data collection

Three research assistants were trained with a view to collecting data from the randomly selected respondents. Prior to administration of the questionnaires, respondents were provided with information about the study and only respondents who gave their consent verbally were interviewed. The heads of households or any household member of thirteen (13) years of age and above were used as the respondents in each household. Each question was explained to the respondents and their answers were recorded on the questionnaire.

Data management and analysis

Data were entered into the computer using the Statistical Package for Social Sciences version 15 (Chicago IL 60606-6412) software which was used for data cleaning and analysis. Frequencies of all variables were applied to check for unexpected codes, missing values, or missing data. Data were analysed using descriptive statistics, *chi square*, *t-test* and ANOVA. P-value of 0.05 was considered statistically significant. The results obtained were presented in charts and tables.

RESULTS

Socio-demographic characteristics of respondents

A total of 427 respondents participated in the study. The population included in the study were composed of males (33.8 %) and females (66.2 %). The mean age of respondents was 34.4±13.6 years.

Table 1: Socio-demographic characteristics of respondents

Variable	Frequency	Percentage (%)
Sex		
Male	137	33.8
Female	268	66.2
Total	405	100
Religion		
Christianity	283	69.9
Islam	120	29.6
Traditional	1	0.2
Others	1	0.2
Total	405	100
Highest level of Education		
No formal education	2	0.5
Islamic education	4	1.0
Primary education	6	1.5
Secondary education	134	33.0
Tertiary education	259	64.0
Total	405	100
Ethnic group		
Yoruba	92	22.7
Hausa	84	20.7
Igbo	89	22.0
Others	140	34.6
Total	405	100
Occupation		
Self-Employed	110	27.2
Civil	84	20.7
Employed in private sector	58	14.3
Student	122	30.1
Unemployed	31	7.7
Total	405	100
Household size		
1-3	78	19.3
4-6	223	55.1
7-9	78	19.3
>9	26	6.4
Total	405	100

Water supply and use

Water source

The results obtained in this study showed that respondents adopted the use of sachet water (38.5%), tap water (26.7%), bottled water (21.7%), borehole water (12.6%) and well water (0.5%) for drinking purpose (Figure 2). These results are in line with a survey study conducted by Taiwan Water Supply Corp regarding consumers' satisfaction with drinking water which showed that 60% of local residents still avoided drinking tap water even though a lot of money was invested to improve traditional treatment processes (Lou *et al.,* 2007). Also, results obtained from the respondents about their main source of water used for cooking revealed that majority (73.3%) use tap water while 21.2% use borehole water (Figure 3).

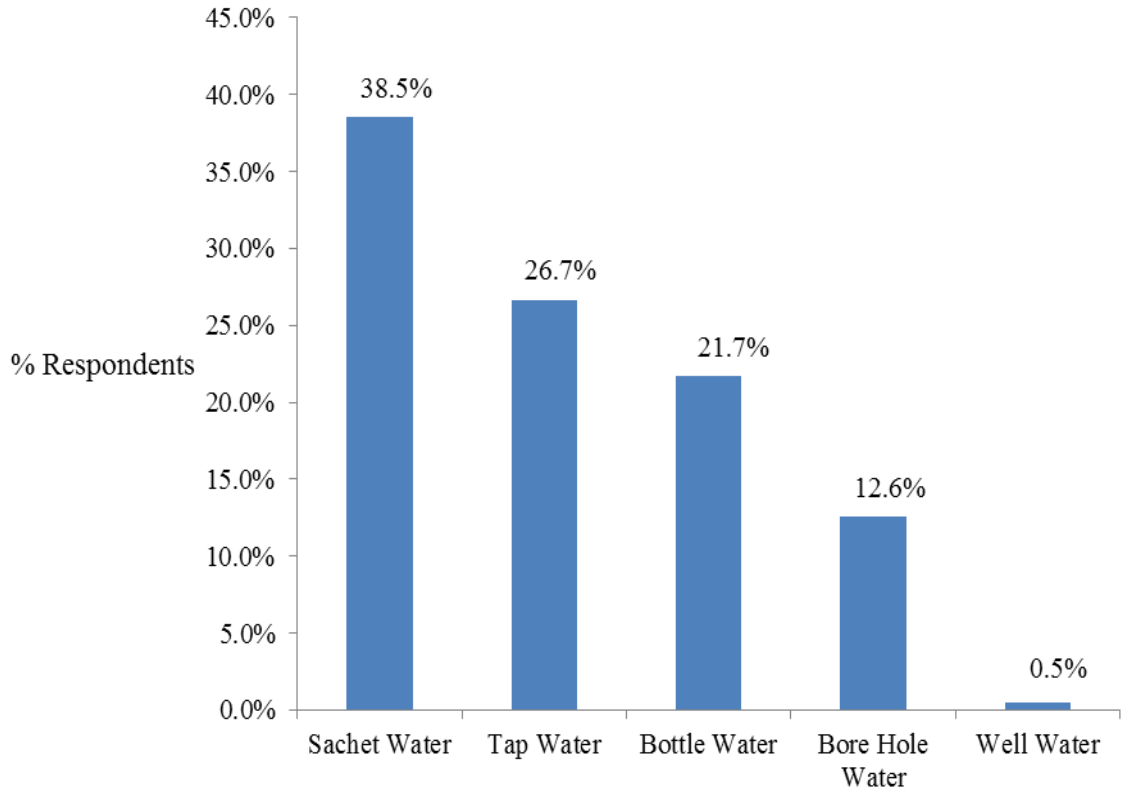

Fig. 2: Sources of water used by respondents for drinking purpose

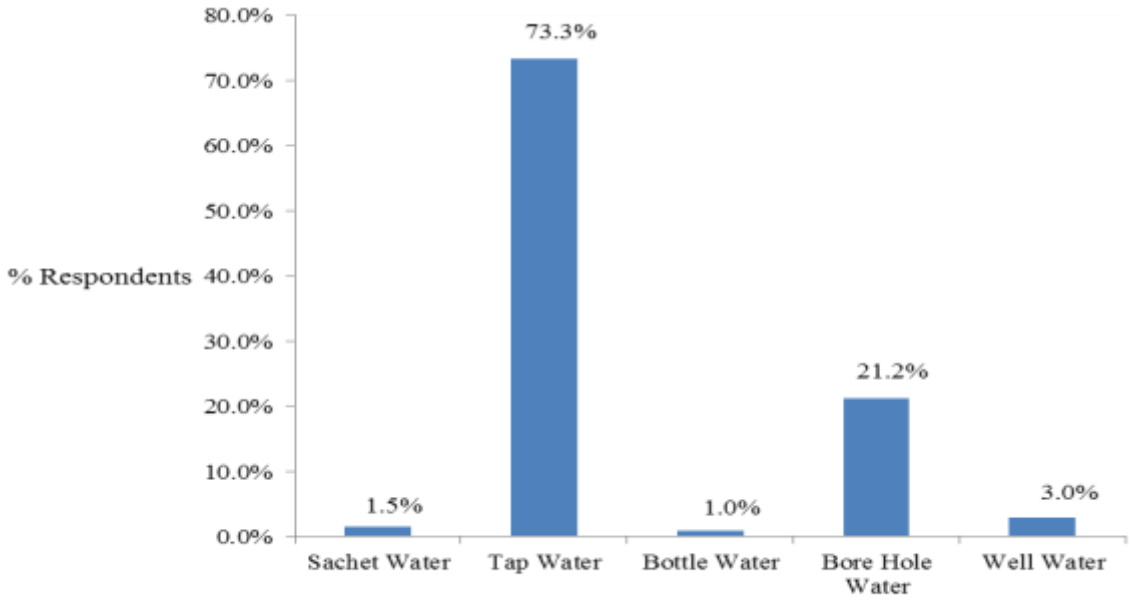

Fig. 3: Sources of water used by respondents for cooking purpose

Municipal water supply

Majority of the respondents (60%) reportedly received intermittent municipal water supply while a sizeable proportion of the respondents (40%) reportedly receive continuous municipal water supply (Figure 4).

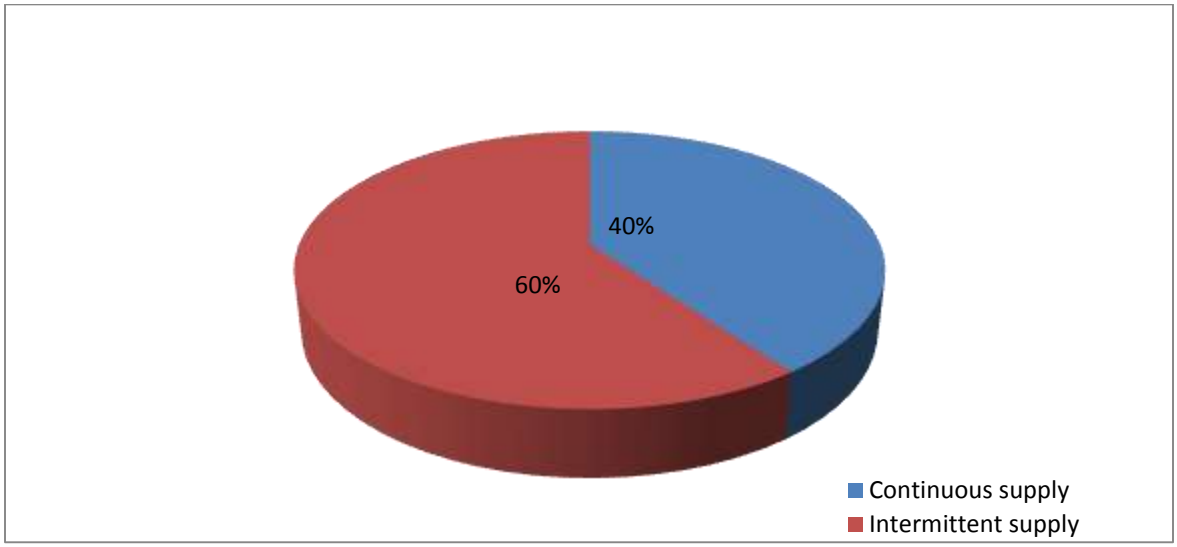

Fig. 4: Trend of municipal water supply to Barnawa community

These results are in line with the submission of Gbadebo and Akinhanmi (2010) but contrary to the report of Odjegba *et al.* (2015).

Alternative water sources

Majority of the respondents (84.4 %) reported that they use alternative water sources as against 15.6% who use only tap water (Figure 5). Out of the majority of the respondents who use alternative water sources, 68.1% reported that they trust the water quality as against 16.3 % that indicated their distrust for the water quality. These results are not unusual as many authors; Alabi and Osagbemi (2005), Aderibigbe *et al.* (2008), Adeleye *et al.* (2018) have reported similar trends in their respective study areas.

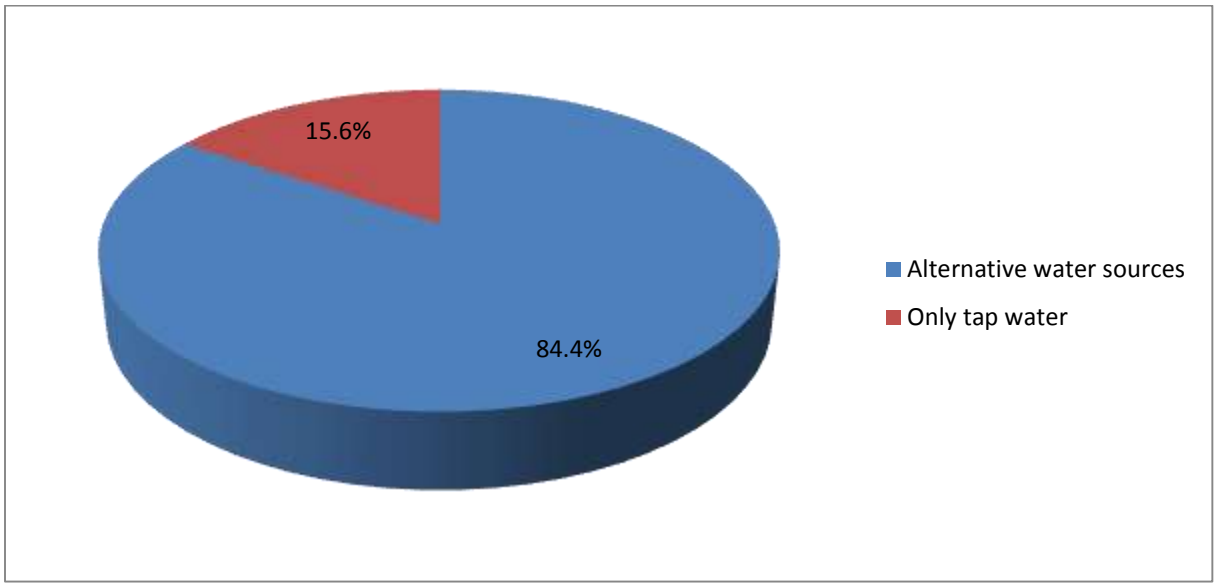

Fig. 5: Respondents' response to the use of alternative water sources

Consumers' perception on water quality

Eight (8) variables were used to assess consumer's perception; municipal water acceptability, perceived health risk, perceived health risk rating, general satisfaction, taste satisfaction, odour satisfaction, colour satisfaction and hardness satisfaction. As done

by Aluko *et al.* (2016), perception scores of ≤4 and >4 were categorised as negative and positive respectively. The results obtained showed that majority of the respondents (52.1 %) had a negative perception of the water quality while 47.9 % had a positive perception of the water quality (Table 2).

Table 2: Consumers' perception of the water quality

Variable	Frequency	Percentage (%)
Acceptable water quality		
Yes	129	31.9
No	211	52.1
Don't know	65	16
Total	405	100
Water poses health risk		
Yes	211	52.1
No	122	30.1
Don't know	72	17.8
Total	405	100
Perceived health risk		
High	43	10.6
Medium	106	26.2
Low	59	14.6
Don't know	3	0.7
Total	405	100
General satisfaction with water quality		
Yes	111	27.4
No	294	72.6
Total	405	100
Satisfaction with water colour		
Yes	146	36
No	259	64
Total	405	100
Satisfaction with water taste		
Yes	272	67.2
No	133	32.8
Total	405	100
Satisfaction with water odour		
Yes	306	75.6
No	99	24.4
Total	405	100
Satisfaction with water hardness		
Yes	377	93.1
No	28	6.9
Total	405	100
Other problems		
Yes	3	0.7
No	402	99.3
Total	405	100

During this study, 72.6 % reported that they were not satisfied with the water quality while 27.4 % reported that they were satisfied. Concerning satisfaction with the odour, 75.6 % reported that they were satisfied while 24.4 % reported that they were not. Majority (64 %) of the respondents were not satisfied with the colour of the water while 36 % reported that they were satisfied with the colour of the water, 67.2 % reported that they were satisfied with the taste of the water while 32.8 % reported that they were not satisfied with the taste of the tap water (Table 2). These results are in agreement with Odjegba *et al.* (2015) in a similar study. Interestingly, in a related study on three suburb areas of Beirut (BurjHammoud, Tahweeta and Bir Hassan), the complaints of consumers also focused on colour (25.5 %) and then (19 %) on taste (El Rez, 2004).

Influence of consumer's perception on the use of tap water for drinking

In order to understand the influence of consumer's perception on the use of tap water for drinking, the association between the independent (predictor) variable, consumer perception and the binary dependent (outcome) variable, use of tap water for drinking, was studied. The association between consumer's perception and use of tap water for drinking is statistically significant ($P<0.05$) (Table 3). The cross tabulation revealed that among those respondents who had a negative perception of the water quality,77.7% did not use the tap water for drinking compared to 22.3% who used the tap water for drinking ($\chi^2 = 4.345$, $p = 0.04$).

Table 3: Association between consumers' perception and use of tap water for drinking

Consumers' perception	Use of tap water for drinking		
	Yes	No	Total
	N (%)	N (%)	
Positive	61(31.4)	133(68.6)	194
Negative	47(22.3)	164(77.7)	211
Total	108	297	405

$\chi^2 = 4.345$ df = 1 p value = 0.04

A logistic regression analysis was performed to ascertain the effects of Municipal water acceptability, perceived health risk, consumer satisfaction with the odour, colour, taste and hardness of the water on the use of the water for drinking. From the results depicted in Table 4, it can be seen that consumers who perceived the municipal water as acceptable were 1.94 times more likely to use it for drinking ($p= 0.02$) compared to those who did not. Also consumers who were satisfied with the odour of the water were 2.83 times more likely to use the water for drinking ($p= 0.01$) compared to those who were not satisfied with the odour.

Influence of consumer's perception on the use of tap water for cooking

In order to understand the influence of consumer's perception on the use of tap water for cooking, the association between the independent (predictor) variable, consumer perception and the binary dependent (outcome) variable, use of tap water for cooking, was studied. The cross tabulation revealed that among those respondents who had a negative perception of the water quality, 72 % used the tap water for cooking compared to 28 % who did not use the tap water for cooking ($p = 0.54$). Again, it can be seen from the results presented in Table 5 that the association between consumer's perception and use of tap water for cooking which is not statistically significant.

Table 4: Logistic regression analysis on the influence of some variables on the use of tap water for drinking

Variable	Odds Ratio	95% C.I.	p- Value
Municipal water acceptability	1.94	1.11 – 3.39	0.02
Perceived health risk	1.12	0.67 – 1.87	0.68
Satisfaction with odour	2.83	1.36 – 5.90	0.01
Satisfaction with colour	0.75	0.44 – 1.28	0.30
Satisfaction with taste	1.05	0.58 – 1.89	0.87
Satisfaction with hardness	0.75	0.29 – 1.93	0.56

Table 5: Association between consumers' perception and use of tap water for cooking

Consumers' perception	Use of tap water for drinking		
	Yes	No	Total
	N (%)	N (%)	
Positive	145 (74.7)	49 (25.3)	194
Negative	152 (72.0)	59 (28.0)	211
Total	297	108	405

$\chi^2 = 0.378$ df = 1 p value = 0.54

A logistic regression analysis was performed to ascertain the effects of Municipal water acceptability, perceived health risk, consumer satisfaction with the odour, colour, taste and hardness of the water on the use of the water for cooking. From the result as shown in Table 6, none of the predictor variables added significantly to the model/outcome.

Table 6: Logistic regression analysis on the influence of some variables on the use of tap water for cooking

Variable	Odds Ratio	95% C.I.	p Value
Municipal water acceptability	1.65	0.92 – 2.97	0.10
Perceived health risk	0.63	0.37 – 1.06	0.08
Satisfaction with odour	1.36	0.75 – 2.47	0.31
Satisfaction with colour	1.04	0.61 – 1.79	0.88
Satisfaction with taste	0.89	0.51 – 1.54	0.67
Satisfaction with hardness	2.10	0.94 – 4.72	0.72

Generally, regarding the influence of the consumers' perception on the usage of water for drinking and cooking the study revealed that a negative perception of the water quality affected the use of the water for drinking. However, this did not affect their use of the water for cooking. This result is in line with a similar study conducted by Umar (2012), where it was determined that the usage of water for drinking was influenced by the perception of the water quality and this affected consumers' choice of drinking the water and also usage of the water for cooking among the respondents was not influenced by their perception about the aesthetic appearance which the author attributed to their awareness that water borne pathogens can be removed through active boiling of such water.

Also, a study conducted in Portugal to analyze tap water risk and quality perception showed that although the use of tap water is influenced by variables such as flavour, familiarity, memorability and risk, it is more influenced by the presence of feasible alternatives such as bottled water. Therefore, when people perceive their tap water as being poor in quality or have a high risk, they tend to use alternative sources of water if they have the option (Doria *et al*., 2009). The high use of sachet water in this study is synonymous with its vast availability in Nigeria.

Water borne diseases

As depicted in Table 7, majority (73.8 %) of the respondents in this current study reported that there was no incidence of water borne disease during the past one year in their family. Only 22.2 % of the respondents reported an incidence of water borne disease in the past one year and respondents (4 %) did not know if there was an incidence of water borne disease.

Table 7: Incidence and type of water borne disease among respondents

Variable	Frequency	Percentage (%)
Incidence of water borne disease within the last one year	90	
Yes	299	22.2
No	16	73.8
Don't know	405	4
Total		100
Type of water borne disease		
Typhoid	52	12.8
Cholera	32	7.9
Diarrhoea	6	1.5
Total	90	22.2

The syndrome known as 'God forbid' described by Olusanya (2009) must have led to the results recorded in this current study. However, as shown in Table 7, water borne diseases suffered by those that reported an incidence indicate typhoid (12.8 %), cholera (7.9 %) and diarrhoea (1.5 %). These results are similar with the reports of Noi (2008), Okonko, *et al*. (2008), O'Reilly *et al.* (2008), Vivas *et al.* (2010), Odjegba *et al.* (2015) and Adeleye *et al*. (2018).

CONCLUSION

During the conduct of this study, at least half of the consumers of municipal tap water had a negative perception of the water quality and majority of the consumers were not satisfied with the colour of the water when compared to other organoleptic characteristics. The water supply in the area was mainly intermittent and majority of consumers used alternative sources of water like hand dug well, borehole, sachet and bottled water. Customers' perception of the water quality affected their choice of the water for drinking but this did not affect their usage of the water for cooking.

RECOMMENDATIONS

Owing to the results obtained in this current study, KSWB should implement a system that ensures continuous water supply in Barnawa community as majority of the consumers complained of intermittent water supply which has been documented to increase the risk of the water getting contaminated in the distribution system before reaching the consumers. The water board should as a matter of necessity should carry out public awareness campaigns regarding household treatment of water which will ultimately help consumers to reduce their expenses on alternative sources of water. Similar studies like this current one should be conducted in the remaining areas of Kaduna state and equally replicated in other states in Nigeria so as to evaluate on a wider scale the quality of water supplied to consumers and their respective perception of such supply.

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